Case Studies Discussion

Module 5

5 - 1

Module Goal

- To explore the application of the National Architecture elements to transit projects

5 - 2

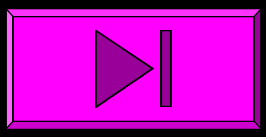
Module Outline

- Intro to the Case Studies
- Case Studies exercise

5 - 3

Intro to the Case Studies

- What's going on in your area?
- Denver, Colorado
- Twin Cities, Minnesota
- Seattle, Washington
- Arch Deluxe, St. Louis



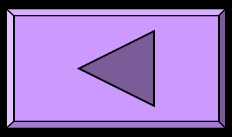
- *Go to the exercise*

5 - 4


What's Going on in Your Area?
Who?
What?
How is it integrated?
5 - 5

Denver, Colorado

- CDOT, local transit operator, police, City DOT and County DOT
- Emergency response and traffic movement improved
- Linked information systems



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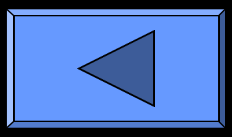
Minneapolis - St. Paul

- MnDOT: traffic and transit
- Integration and sharing of information
- Info systems connections include:
  - Cities, county and state jurisdictions
  - Freeway management and maintenance dept, state patrol, metro transit, and city parking management



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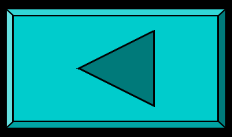
Seattle, Washington

- WSDOT
- Linking transportation and traveler info systems



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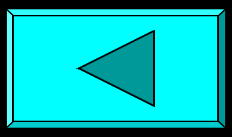
Arch Deluxe, St. Louis

- Missouri DOT, St. Louis and St. Charles Counties traffic and transit, private local ISP, St. Louis EMS Dept.
- Impact of new theme park on the area
- MPO will be updating the Early Deployment Plan (EDP) to get agency buy-in to regional integration



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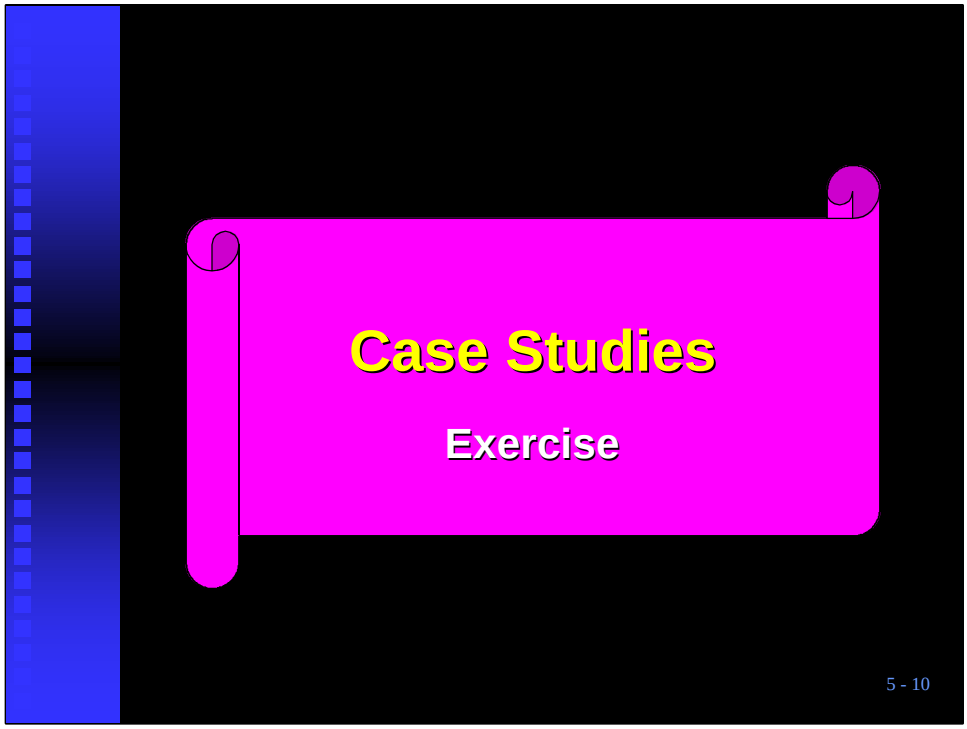
Case Studies
Exercise
5 - 10

Summary

- Lessons learned

5 - 11

Module 5: Case Studies

Applying the National ITS Architecture

Introduction

The first case study "What's going on in Your Area" is one that you will write.

The next three case studies illustrate the processes used in, and benefits realized from, integrating technologies using the framework provided by the National ITS Architecture. The studies have been gathered from reports and personal contacts with implementing agencies.

- *Source: National ITS Architecture and Standards Resource Guide, Sept. 1998.*

The final case is a hypothetical case based on a scenario that could happen in St. Louis, Missouri.

What's Going on in Your Area

Description Describe the "who, what, where" of one project or challenge in your area.

The Blueprint Describe how the national and/or regional architecture fits in to the project.

Continued on next page

What's Going on in Your Area, Continued

Integration

Describe integration efforts that have been accomplished and/or will be needed in your area in the future.

Stakeholders

Describe the stakeholders that are involved.

Continued on next page

What's Going on in Your Area, Continued

Summary Summarize key points.

Continued on next page

What's Going on in Your Area, Continued

1

How did you use the National Architecture to implement the project?

2

How did the Architecture aid integration of systems?

3

How did you handle existing systems?

4

How did you provide for future expansion?

Continued on next page

What's Going on in Your Area, Continued

5

What cost and/or time savings were realized by conforming to the Architecture?

Applying the National ITS Architecture: Improving Emergency Response in Denver, Colorado

Description

The Colorado Department of Transportation (CDOT), the local transit operator, the police, and the City and County transportation departments improved emergency response and traffic movement in the Denver metropolitan area by linking their information systems.

The partners are connected to CDOT's traffic management center (TMC), where they have access to all video images and other available information, improving each agency's operations.

- If the police need to view an area that is not covered by their cameras, they can share cameras operated by the transit operator, TV stations, or CDOT - all without leaving the police dispatch center.
- This enhanced video coverage enables police patrol cars and other emergency vehicles to be dispatched to an accident scene more promptly to aid victims and clear the roadway.
- It is cost-effective because it reduces the dispatch of unnecessary assistance, and helps to get the right kind of help to an accident scene as quickly as possible. Traffic back-ups resulting from an accident or special event are reduced as vehicles are diverted to other routes as necessary, and drivers have information to make more informed decisions regarding how and when to travel.

The Blueprint

The core of CDOT's integrated information system is their system architecture – the "blueprint" for how agencies communicate and exchange information.

The architecture is a key factor in the effective design of complex information systems, which can be very time consuming to engineer. By using the National ITS Architecture as a foundation, CDOT cut six months from the time needed to create their architecture, thereby significantly reducing the development cost.

- With the assistance of a consultant, Lockheed Martin, CDOT selected the technologies and services they needed, both immediately and in the future, from the National ITS Architecture to create an architecture that would meet the unique requirements of the Denver region.

Continued on next page

Applying the National ITS Architecture: Improving Emergency Response in Denver, Colorado, Continued

Planning for the future

In addition, because they planned for their entire system at once and represented it through their architecture, the different agency partners will avoid the need for costly software and hardware changes that often are required as information systems evolve. Thus, all of the agencies can make cost-effective decisions about equipment purchases now and will continue to realize savings in the future.

Identification of linkages

The National ITS Architecture also helped identify possible current and future opportunities for expanding technology integration through linkages to other agencies.

- CDOT's architecture provides the basis for expansion and allows the designation of "placeholders" for future services, such as systems related to commercial vehicle applications, which will not be developed until a later date.
- Because the National ITS Architecture supports multiple vendors, CDOT will be able to take advantage of price competition when choosing among vendors for the development of specific systems.

The "legacy" systems

CDOT also is saving time and money by using the regional systems architecture to guide integration of existing, or "legacy," systems, which will continue to operate in the Denver region with new systems, both now and in the future.

- These older systems were not designed to communicate with other systems; thus connecting old and new systems makes planning more complex.
- The Denver regional systems architecture provides a framework that incorporates legacy systems into the overall plans, while supporting the movement toward future open systems.

Continued on next page

Applying the National ITS Architecture: Improving Emergency Response in Denver, Colorado, Continued

Summary

By using the blueprint in the National ITS Architecture to integrate information technologies, transportation operators and emergency response organizations in the Denver area can do their jobs more efficiently and effectively.

- They will send medical assistance faster to accident scenes, make regional travel safer, help traffic move faster, and aid drivers in making better decisions about their travel choices.
- Local communities will benefit in time saved, lower travel costs, and safer trips.

Source: Personal interviews with Systems Chief of Lockheed Martin, ITS

Continued on next page

Applying the National ITS Architecture: Improving Emergency Response in Denver, Colorado, Continued

1

How did they use the National Architecture to implement the project?

2

How did the Architecture aid integration of systems?

3

How did they handle existing systems?

4

How did they provide for future expansion?

Continued on next page

Applying the National ITS Architecture: Improving Emergency Response in Denver, Colorado, Continued

5

What cost and/or time savings were realized by conforming to the Architecture?

Applying the National ITS Architecture: Minneapolis-St. Paul, Minnesota's Strategy for Sharing Information

Description

The Minnesota Department of Transportation (MnDOT) is using the National ITS Architecture to integrate the information systems of key organizations in the Minneapolis-St. Paul region.

This allows MnDOT to provide traffic and transit information to the traveling public and to keep traffic moving smoothly regionwide.

- Cities, county, and state traffic signal operation centers will continue to operate their own traffic management centers, but will soon be connected, so they can share traffic signal, volume, and incident data.
- Traffic operators will know in advance if congestion at their jurisdictional boundaries is getting worse. They will be able to adjust their traffic signals before the congestion turns into gridlock, helping traffic to move smoothly within their own borders and from one jurisdiction to the next.

Before the systems were integrated, using the framework of the National ITS Architecture, traffic operators could view travel activity only within their individual jurisdictions.

Integration

Information systems will also be connected for MnDOT's freeway management system and maintenance department, the state patrol, metro transit, and a city parking management group, so that they will be able to share traffic data and coordinate their operations.

The shared data will include information covering roadway and transit conditions, and will be sent to a private traveler information center to be made available to the public, in real-time, on the Internet and by telephone.

- Drivers throughout the region will be able to choose how and when to travel, commuters will get to work and home faster, and commercial vehicles will deliver their products and services more reliably.
- Timely information can also highlight the attractiveness of transit and save time for individual travelers.
- More transit trips means less congestion because fewer vehicles are on the road, so freight and other critical traffic can move more quickly.

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Applying the National ITS Architecture: Minneapolis-St. Paul, Minnesota's Strategy for Sharing Information, Continued

The blueprint

Designing and integrating information systems is a complex task that is made easier by using a framework, or architecture, to assess available and required data and how it will be shared among organizations.

MnDOT staff saved time by using the National ITS Architecture as a starting point rather than developing an architecture from scratch.

- Using the blueprint in the National ITS Architecture, MnDOT created a statewide architecture that was then applied within the Minneapolis-St. Paul metropolitan area.
- The National ITS Architecture helped them conceptualize and plan for the entire system up-front.
- The resulting statewide architecture identified the jurisdictions involved, defined the technologies to be implemented, and provided a master blueprint to ensure that the various pieces will work together.

Stakeholders

Stakeholders from transit agencies and the county, as well as law enforcement personnel, were involved in adapting the statewide architecture to the Minneapolis-St. Paul region.

- The system descriptions drawn from the National ITS Architecture allowed stakeholders to know precisely what to expect, making it easier to deploy the projects that grew out of this cooperative decision-making process.
- The National ITS Architecture will also help facilitate future cooperation among stakeholders.

Continued on next page

Applying the National ITS Architecture: Minneapolis-St. Paul, Minnesota's Strategy for Sharing Information, Continued

Summary

The blueprint provided by the National ITS Architecture also pointed out ways for project planners and engineers to take advantage of system integration opportunities.

- Consistent with the National ITS Architecture, each traffic jurisdiction will continue to operate independently, while electronically transmitting data to and from the others.
- Thus they will have the benefits of better and more complete data, including obtaining a regional perspective for traffic patterns. At the same time, they will be able to avoid any single point of vulnerability that could result in system-wide failure.
- Sharing data with other jurisdictions helps prevent traffic congestion and ultimately keeps people and goods moving to support the city and region's economies and meets their constituents' busy schedules.

Source: Personal interviews with MnDOT staff, Metro Division

Continued on next page

Applying the National ITS Architecture: Minneapolis-St. Paul, Minnesota's Strategy for Sharing Information, Continued

1

How did MnDOT use the National Architecture to implement the project?

2

How did the Architecture aid integration of systems?

3

How did they handle existing systems?

4

How did they provide for future expansion?

Continued on next page

Applying the National ITS Architecture: Minneapolis-St. Paul, Minnesota's Strategy for Sharing Information, Continued

5

What cost and/or time savings were realized by conforming to the Architecture?

Applying the National ITS Architecture: Meeting Increased Travel Demand in Seattle, Washington

Description

The Washington State DOT (WSDOT) is linking the transportation and traveler information systems of key public agencies in the Puget Sound Region to meet the increasing demands placed on the transportation infrastructure by travelers, tourists, and businesses as the population grows and economic activity increases.

For example, traffic operation centers for freeways and arterial roadways now share video images, providing each center with a regional view of congestion and incidents.

- Traffic managers in the cities of the South Puget Sound can view the traffic entering their jurisdictions, adjust traffic signals before congestion turns into gridlock, and decrease travel time so commuters get home faster and goods and services are delivered on schedule.
- The efficient movement of goods is particularly important in this area because of the critical role played by the Seattle and Tacoma ports in Pacific Rim commerce.

Improved information systems

WSDOT has realized the benefits of information systems in this region since the 1960's; however, most systems have previously operated somewhat independently of one another. Now, transportation information systems are being integrated to maximize their benefits, increase their usefulness, and provide more complete information to operators and travelers.

- Travelers and businesses will get information on current freeway and arterial conditions, bus and ferry transit options, and airport vehicular traffic information.
- All this will be available through pagers, the Internet, airport display terminals, and at transit stations.

With better information, travelers can decide when and how to travel, and can reduce the time lost to congestion.

- Businesses can rely on receiving their just-in-time deliveries as scheduled.
- Tourists will be able to make bus and ferry connections with ease and confidence.
- Transit riders will know before leaving their homes whether their bus is going to be on time, making transit a more attractive transportation option.

Continued on next page

Applying the National ITS Architecture: Meeting Increased Travel Demand in Seattle, Washington, Continued

The blueprint

Planning for the integration of technologies is made easier by using a blueprint, or architecture. Creating an architecture from scratch is a complex, resource intensive undertaking.

In the Puget Sound region, local officials used the framework provided by the National ITS Architecture to create a systems architecture tailored to the region's unique needs.

- Matching the existing infrastructure with the transportation services identified in the National ITS Architecture reduced by half the time it would have taken to create a regional architecture from scratch.
- The National ITS Architecture helped identify gaps, as well as duplications in local services in such areas as public transit safety, commercial vehicle operations, and electronic fare and toll payment services.
- This analysis provided a reasoned foundation from which to more accurately identify future needs, and to compete effectively for scarce public resources.

Increased communication

In addition, the common language provided by the National ITS Architecture helped public agencies communicate better with each other and with the private companies involved with enhancing and implementing the regional architecture.

- Public and private sectors came to understand each other better as they discussed complex technical issues.
- The National ITS Architecture's common language helped vendors work with the public sector to identify regional needs.
- By comparing their products to the National ITS Architecture, vendors could better explain their products and services to public agencies.

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Applying the National ITS Architecture: Meeting Increased Travel Demand in Seattle, Washington, Continued

Summary

Finally, WSDOT is using the framework provided in the National ITS Architecture to decide how best to integrate existing, or "legacy," systems with new systems.

The National ITS Architecture is helping to guide decisions on which legacy systems are candidates for integration, and which will be difficult to integrate and should be replaced through future projects.

Source: Technology Based Transportation Solutions, Model Deployment Initiative, FHWA; Personal interviews with Battelle Pacific NW Division staff

Continued on next page

Applying the National ITS Architecture: Meeting Increased Travel Demand in Seattle, Washington, Continued

1

How did WSDOT use the National Architecture to implement the project?

2

How did the Architecture aid integration of systems?

3

How did they handle existing systems?

4

How did they provide for future expansion?

Continued on next page

Applying the National ITS Architecture: Meeting Increased Travel Demand in Seattle, Washington, Continued

5

What cost and/or time savings were realized by conforming to the Architecture?

Applying the National ITS Architecture: Arch Deluxe

Scenario

This Concepts Application Exercise presents a sample situation which simulates the process of "accelerated" deployment and integration of various ITS projects. Over the three days of this course, you will address the transportation challenges that arise with the development of the "Arch Deluxe" theme park in the St. Louis, Missouri metropolitan region.

- The "Arch Deluxe" theme park and many of the conditions presented in this Concepts Application Exercise are fictional in nature.

- There are several workable and effective solutions to the various problems presented in this Concepts Application Exercise. The sample solutions provided are only examples.

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Applying the National ITS Architecture: Arch Deluxe, Continued

Situation

A private sector developer has just received local approval to locate a major theme park in the St. Louis metropolitan region. The theme park is expected to accommodate 90,000 visitors per day (peak season forecast). This will result in 30,000 vehicles per day into the park, including approximately 5,000 employee vehicles and buses. Figure 1 shows the location of the theme park outside the city of St. Louis.

- Because of geographic and topographic limitations, only one entrance to the park could be allowed.
  - This entrance is onto a four lane arterial adjacent to the site, with a nearby interchange with I-270.
  - Both the arterial and interchange are already congested.

The roadway improvements needed for the theme park have been identified as part of the local approval process. The improvements will be funded primarily by the developer and are included in the MPO's Transportation Improvement Program (TIP). The improvements are adding two general purpose lanes to the arterial from the theme park's entrance to the I-270 interchange and minor interchange improvements.

The project has accelerated the start of a Major Investment Study (MIS) the MPO will conduct for a corridor that extends from the airport to the City of St. Charles.

- The MIS is not expected to be completed by the time the theme park opens, but a focal point of the effort is access from the park to the airport.
  - The major arterial streets around the airport and between the airport and the theme park are highly congested during peak periods.

A light rail line runs between the region's international airport and the downtown area, connecting a number of key destinations in-between (e.g., stadium, hospital, convention center, etc.) A bus "feeder" service currently operates from the surrounding areas to most stations on the rail line, but not to the airport station.

There is no space for hotels on the park property, but several hotels are located near the international airport about four miles away and in the downtown area about ten miles away.

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Figure 1

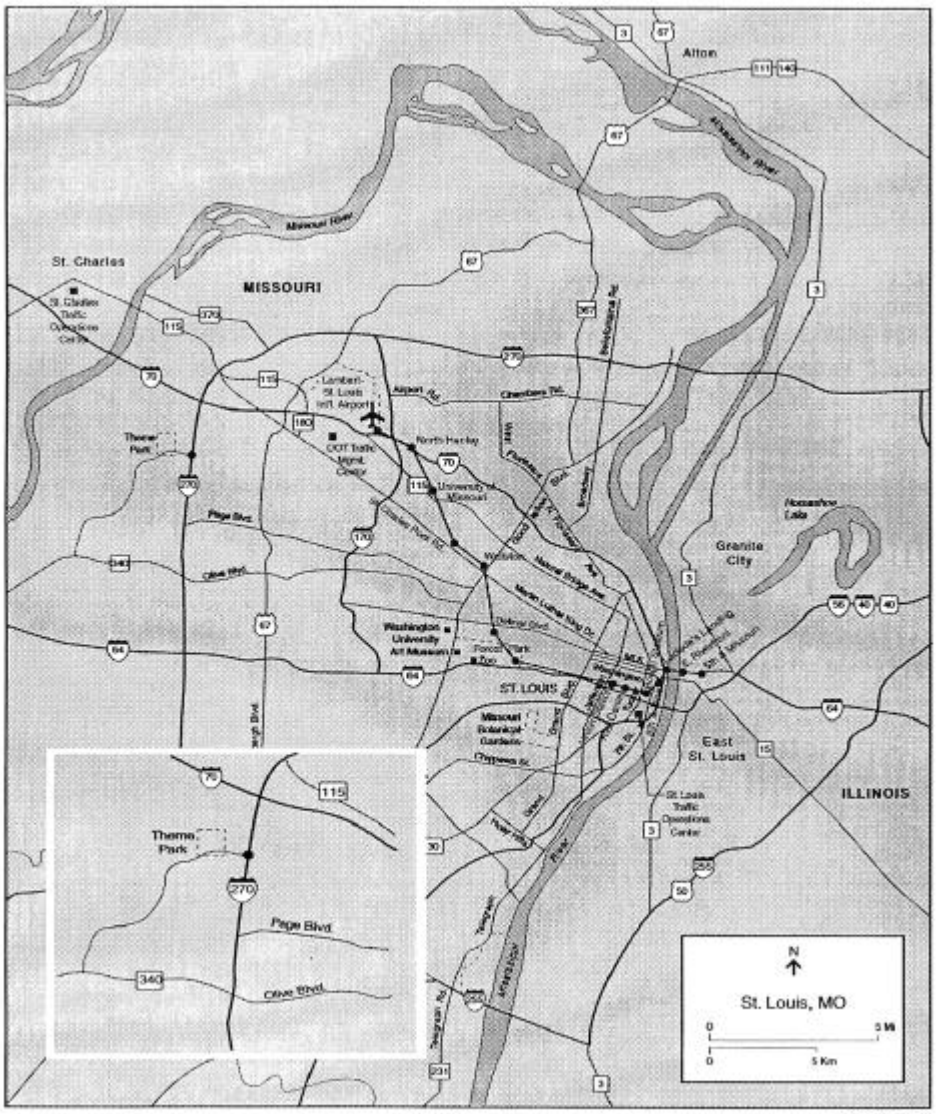

Figure 2

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EDP

The MPO completed an Early Deployment Plan (EDP) five years earlier.

- Most of the regional integration recommendations of the plan have not been implemented.
  - However, agencies have deployed or are planning to deploy ITS projects identified in the plan.
  - The MPO is considering an update to the EDP, primarily to get agency buy-in to regional integration.

ITS projects

The ITS projects that are in place or programmed are:

- a freeway management system on I-70 from downtown St. Louis to St. Charles, operated by the Missouri Department of Transportation (DOT) from a transportation management center near the project;
- traffic signal systems on most of the adjacent arterial roadways operated by St. Louis and St. Charles Counties, each having a separate traffic operations center;
- a traffic information service provided by a private local company with feeds to local radio and television stations;
- an incident management program under development by the Missouri DOT and the St. Louis County Emergency Management Services Department that should be deployed by the time the theme park opens (the plan is to expand into St. Charles County); and,
- an automated vehicle location (AVL) system to be purchased by the transit agency within the next year, with the primary intention of improving the operations of the bus fleet through fleet management and on-schedule adherence.

Summary

The table on the following page summarizes the ITS applications that will influence or be influenced by the theme park.

Continued on next page

Applying the National ITS Architecture: Arch Deluxe, Continued

SUMMARY OF ITS PROJECTS IN THE STUDY AREA		
ITS Infrastructure Components	**Existing and Programmed ITS Projects**	**Lead Agency**
Traffic Signal Control	• Computerized signal system on major arterials leading to the theme park. • Each county has its own traffic signal system center.	St. Louis County and St. Charles County
Freeway Management (I-70 from St. Louis to St. Charles)	• Traffic sensors/detectors • Highway Advisory Radio (HAR) • CCTV surveillance • Variable message signs • Traffic management center	Missouri DOT
Transit Management	*Transit agency will purchase an Automated Vehicle Location (AVL) system in the next year for fleet management and on-schedule adherence operations.*	*Transit Agency*
Incident Management	• *CCTV access at police and EMS stations (programmed)* • *Pre-planned diversion strategies* • *Courtesy patrols and tow truck arrangements*	*Missouri DOT*
Electronic Fare Payment	*Theme park has interest in Smart Card for all theme park transactions, with an interest in transportation uses.*	*Theme park developer*
Electronic Toll Collection	NA	
Highway-Rail Intersections	NA	
Emergency Management Services	*EMS priority is planned.*	St. Louis County EMS
Traveler Information Systems	*Theme park developer has interest in information kiosks at the park, at the airport and in hotels.* *Commercial traffic reporting service has interest in cable TV station.*	*Theme park developer, Commercial reporting service*
Communications	*Connections between the FMS and IM are programmed.*	*Missouri DOT*

Projects and agencies in italics are planned or programmed.

Integration

In addition to the roadway improvements noted above, the theme park development agreement requires the developer to work with local agencies and the Missouri Department of Transportation on an integrated ITS response to the park's transportation system impacts. The MPO sees this integration effort as a possible "kick-start" and building block to the regional integration effort envisioned by the EDP.

Fare cards

One of the developer's concepts for the theme park is use of a "Smart Card" for all financial transactions within the park. The developer also thinks that there are future opportunities to link this concept to transportation, but needs some help in determining how to achieve this. Another concept is setting up information kiosks, some to be located in the park and some outside the park in places such as local hotels and the airport. The kiosks will provide information about upcoming events at the park, hotels and restaurants in the area, and travel options and schedules.

Stakeholders

The developer has invited several agencies to participate in defining what should be done to incorporate and integrate ITS applications into the project. Thus, initial stakeholders of the theme park include the following at a minimum:

- Theme park developer (private sector interest)
- Missouri Department of Transportation (DOT)
- St. Louis and St. Charles County Transportation Departments
- East-West Coordinating Council Metropolitan Planning Organization (MPO)
- Transit agency/property
- Commercial traffic reporting service (private sector interest)
- St. Louis and St. Charles Police and Emergency Services Departments
- Divisional representative(s) (FHWA and/or FTA)
- Regional Visitors Bureau

Continued on next page

Applying the National ITS Architecture: Arch Deluxe, Continued

1

How will Arch Deluxe be able to use the National Architecture to implement the project?

2

How can the Architecture aid integration of systems?

3

How should they handle existing systems?

4

How can they provide for future expansion?

Continued on next page

5

What cost and/or time savings can be realized by conforming to the Architecture?

6

Use the table on the following page to identify several transportation issues or problems that may result from the theme park project.

- List specific agencies involved in the second column.
- Check off the ITS project that the issue relates to in the *Potential Improvements* column.

Continued on next page

Applying the National ITS Architecture: Arch Deluxe, Continued

ISSUES/PROBLEMS AND POTENTIAL IMPROVEMENTS									
Agency	*Issues/Problems*	*Potential Improvements*							
		TSC	FMS	TMS	IM	EFP	ETC	HRI	EMS	TIS

Potential Improvements acronyms:

- TSC – Traffic signal control
- FMS – Freeway management system
- TMS – Transit management system
- IM – Incident management
- EFP – Electronic fare payment
- ETC – Electronic toll collection
- HRI – Highway and rail intersection
- EMS – Emergency management system
- TIS – Traveler information system

**Roadway improvements for the theme park have been defined and agreed upon in the development order.*

TABLE 4: TRANSIT CONCERNS IN ITS IMPLEMENTATION	
Concerns	***The Architecture offers the following solutions***
FUNDING	
• Reduced funding and shrinking budgets have forced prioritization of critical projects and sacrifice of any projects "less than critically needed." • Even when ITS projects will save significant operations and maintenance costs over time, the agency often lacks staff to conduct the analyses required to gain support for the ITS projects.	• A wide range of funding resources (particularly at the federal level) are now available. • Interagency and inter-jurisdictional approaches to procurements of ITS systems can spread costs over a larger number of agencies. • Public/private partnerships can leverage private sector resources to complement the agencies' contributions.
MAINTAINING BASIC SERVICE QUALITY	
With reduced funding, many transit systems spend most of their resources on maintaining basic transit service. • In order to preserve ridership, these basic services receive priority when project funding decisions are made.	Basic service quality can be greatly enhanced through ITS implementation: • Improved traveler information and other services such as signal priority can increase ridership by making transit more appealing to travelers. • Increased revenues can provide agencies with funding for other critical projects. • By consolidating fare payment across transportation modes, transit agencies can simplify their financial management operations. • Enhanced fleet management can reduce the number of buses or trains needed by a transit agency. • ITS data collection technologies (e.g., AVL and automatic passenger counters) allow agencies to maximize fleet usage by providing more accurate and detailed ridership information, thus allowing agencies to develop more efficient routes and schedules.
QUANTIFIABLE BENEFITS	

TABLE 4: TRANSIT CONCERNS IN ITS IMPLEMENTATION	
Concerns	***The Architecture offers the following solutions***
Declining resources require projects to have clear and quantifiable benefits, such as statistics on improved safety, increased operating efficiency, and reduced operating costs. • Transit agencies lack this information when considering and planning for transit ITS projects, and even more frequently lack the staff required to conduct such analyses.	FTA and FHWA are compiling benefits data as more and more transit agencies deploy ITS systems. • Transit ITS applications are providing significant, measurable benefits *(see "Transit ITS Success Stories" in the ITS Deployment Guidance for Transit Systems Executive Edition).*
MISCONCEPTIONS OF ITS CAPABILITIES	
• Myth: "the focus of ITS is more on highways than transit." • Myth: ITS applications have "Star Wars" type technologies These misunderstandings have discouraged transit operators from fully embracing ITS technologies. • Many transit officials express concern in implementing ITS without a clear sense of how a truly multimodal, integrated national transportation system is likely to be developed.	• ITS applications for transit and intermodal integration of ITS components have only recently received widespread attention. • Fact: ITS systems have been operating successfully for years and have provided substantial benefits to day-to-day transportation operations. The National ITS Architecture clearly identifies areas within the ITS program where transit plays a critical role. • These ITS applications will provide transit users with improved service quality and increased operating efficiency.
ABILITY TO MAINTAIN SYSTEMS OVER TIME	
The ability of transit systems to maintain ITS applications over time is a concern for transit operators, particularly in light of shrinking budgets. • New technical systems that have become too complicated for many of the existing staff (operators, dispatchers, and bus mechanics) require training and retraining programs, or may change hiring practices of many agencies.	The National ITS Architecture promotes a phased implementation approach that encourages maximum use of private sector resources to assist in operations and maintenance of the systems. • Phased implementation allows the agency time to develop a work force with necessary skills to manage and operate systems, while private sector companies, which install ITS systems, can be contracted to provide necessary maintenance and operational assistance, which may also reduce agency costs.
FEAR OF INSTALLING OUTDATED OR PROPRIETARY EQUIPMENT	

TABLE 4: TRANSIT CONCERNS IN ITS IMPLEMENTATION	
Concerns	***The Architecture offers the following solutions***
• Procurement is time consuming. • Technology changes quickly. Fear: ITS procurements will quickly become outdated. Fear: I'll install an ITS systems that will not be upgradeable or compatible with future ITS transit applications or other modal ITS systems.	The National ITS Architecture is designed to encourage and support interoperability, compatibility, and multi-functionality. • lays the foundation for the development of national and international standards, "off-the-shelf technology"